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(54) Method and apparatus for providing network access over different wireless networks

(57) A communication system (200) has a plurality of wireless communication devices (202, 204, 206) coupled through a plurality of wireless network carriers (208, 210, 212) providing wireless communication services thereto using a different combination of network type and transport protocol. A multi-network gateway (214) couples the wireless network carriers to a network of computers (216, 218, 220) containing information therein to facilitate data transfer therebetween. The wireless network carriers are coupled to the network of computers by an airlink configured for the particular combination of network type and protocol, and each of the airlinks operate to exchange data with certain of the wireless communication devices via the wireless network carriers associated therewith.

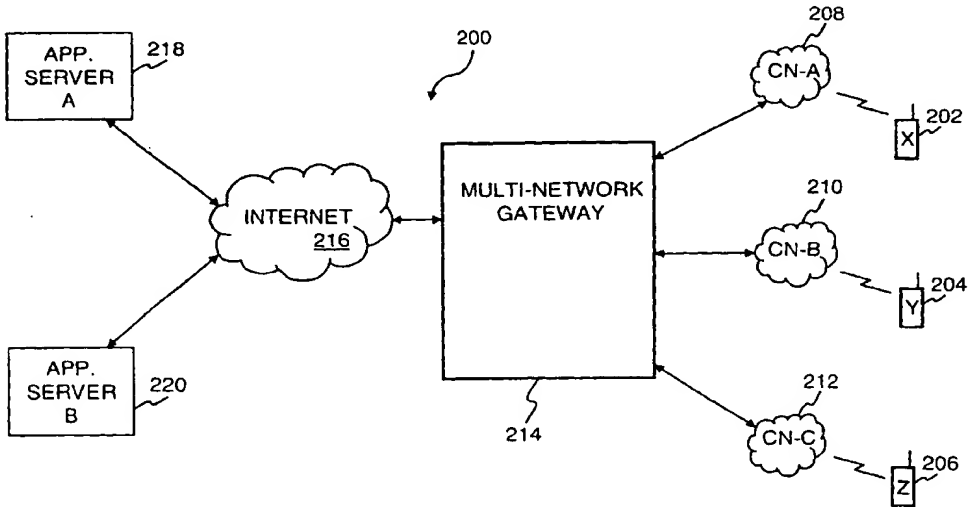

Fig.2

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the network gateway and the various wireless network carriers.

[0009] The invention can be implemented in numerous ways, including as a method, an apparatus, and a computer system. Several embodiments of the invention are discussed below.

[0010] As a system for delivery of information from a network of computers to wireless communication devices, an embodiment of the invention includes: a plurality of wireless communication devices, the wireless communications devices including a processing unit and a display screen; a plurality of wireless network carriers, each of the wireless network carriers providing wireless communication services to the plurality of wireless communication devices, and a plurality of the wireless network carriers using a different combination of network type and transport protocol; a network of computers, one or more of the computers of the network of computers contains information; and a multi-network gateway, the multi-network gateway couples the wireless network carriers to the network of computers to facilitate data transfer therebetween, each of the plurality of the wireless network carriers using the different combination of network type and protocol are coupled to the network of computers by an airlink configured for the particular combination of network type and protocol, and each of the airlinks operate to exchange data with certain of the wireless communication devices via the wireless network carriers associated therewith.

[0011] As a gateway between a plurality of wireless network carriers and the Internet, where each of the wireless network carriers provide wireless communication services to a plurality of wireless communication devices, an embodiment of the invention includes: a HTTP interface module coupled to the Internet, a push agent, and a pull agent. The HTTP interface module interconnects the gateway with the Internet. The push agent is coupled to the HTTP interface module and includes a network driver for each of the wireless network carriers. The push agent operates to receive notification messages for particular ones of the wireless communication devices, and to forward the notification messages to the particular ones of the wireless communications devices by the network driver associated with the wireless network carrier respectively used by the particular ones of the wireless communications devices. The pull agent is coupled to the HTTP interface module and includes a network driver for each of the wireless network carriers. The pull agent operates to receive information requests for information from the Internet from particular ones of the wireless communications devices, to form HTTP requests to request the information from the Internet via the HTTP interface module, to thereafter receive HTTP responses from the Internet containing the information requested, to form information replies for the particular ones of the wireless communications devices based on the HTTP responses, and then to send the information replies to the particular ones of the wireless communications devices as per the information requests using the network driver associated with the wireless network carrier respectively used by the particular ones of the wireless communications devices.

[0012] As a method for exchanging data between the Internet and wireless communication devices, an embodiment of the invention includes the acts of: identifying an incoming request for data from the Internet from a first wireless communication device of a plurality of wireless communication devices, the incoming request being via a first carrier network of a plurality of carrier networks of different network types which use different protocols, the first carrier network having a first network type and using a first protocol; associating the incoming request for data with a first network driver configured to receive requests for data from the first carrier network in accordance with the first network type and the first protocol; receiving the incoming request for data at the first network driver; forming an HTTP request for data based on the received request for data; and forwarding the HTTP request for data to the Internet.

[0013] As a method for providing data from a wired network to wireless communication devices, an embodiment of the invention includes the acts of: receiving a notification from the wired network that is to be directed to a first wireless communication device of a plurality of wireless communication devices via a first carrier network of a plurality of carrier networks of different network types which use different protocols, the first carrier network having a first network type and using a first protocol; formulating a notification message to inform the first wireless communication device of the notification; determining a first network driver associated with the first wireless communication device from a plurality of network drivers, the first network driver being configured to send notification messages to the first wireless communication device via the first carrier network in accordance with the first network type and the first protocol; and sending the notification message to the first wireless communication device using the first network driver.

[0014] As a computer readable medium containing program code for interactive data exchange data between the a wired network and wireless communication devices, an embodiment of the invention includes: first program code for identifying an incoming request for data from the wired network from a first wireless communication device of a plurality of wireless communication devices, the incoming request being via a first carrier network of a plurality of carrier networks of different network types which use different protocols, the first carrier network having a first network type and using a first protocol; second program code for associating the incoming request for data with a first network driver configured to receive requests for data from the first carrier network in accordance with the first network type and the first protocol; third program code for receiving the incoming request for data at the first network driver; fourth program code for forming a wired network request for data based on the received request for data; and fifth program code for forwarding the wired network request for data to the wired network.

[0015] As a computer readable medium containing program code for providing data from a wired network to wireless

couples to the Internet via a carrier network B (CN-B) 210, and the wireless communication device 206 couples to the Internet through a carrier network C (CN-C) 212. Each of the carrier networks 208, 210 and 212 can have a different network type as well as use a different protocol. Hence, the communication system 200 is able to support many different wireless carrier networks with a single, or central, multi-network gateway. Given the large number of different wireless carrier networks, the ability to support different carrier networks is an advantage.

[0022] The communication system 200 also includes a multi-network gateway 214. The multi-network gateway 214 is able to couple various wireless carrier networks with different network characteristics to the Internet 216. In other words, the communication system 200 enables the wireless communication devices 202, 204 and 206 to access and retrieve information from the Internet via the multi-network gateway 214 regardless of differences in the wireless carrier networks 208, 210 and 212. Hence, even though different wireless carrier networks are coupled to the Internet 216 by the multi-network gateway 214, the ability to access and retrieve information from the Internet 216 is available to each of the wireless communication devices 202, 204 and 206 regardless of the particular wireless carrier network 208, 210 and 212 being utilized.

[0023] The wireless communication devices 202, 204 and 206 will often seek to obtain information from application servers located on the Internet 216.FIG.2 illustrates a representative application server A 218 and a representative application server B 220 of or on the Internet 216. For example, the wireless communication devices 202, 204 and 206 may seek to obtain information from the application server A 218 or the application server B 220 located on the Internet 216. As an example, the application server A 218 can be associated with an e-mail application program that provides e-mail services for wireless communication devices. On the other hand, the application server B 220 can be associated with a stock information service that provides stock update notifications and other stock information to registered subscribers with wireless communication devices.

[0024] Although the embodiment of the invention described with reference to FIG. 2 provides access to the Internet, the invention more generally provides access to a network of computers which would include, for example, the Internet and intranets. Moreover, in FIG. 2, the carrier networks A, B and C 208, 210 and 212 are illustrated and it is assumed that each of these carrier networks are different. The carrier networks are different in the type of network they implement and/or in the particular protocols they use. However, it should be understood that nothing prevents the communication system 200 from including certain carrier networks that implement the same network type with the same protocols as other carrier networks within the communication system 200. Still further, although the carrier networks 208, 210 and 212 are illustrated as supporting the wireless communication devices 202, 204 and 206, respectively, it should be understood that normally each of the carrier networks 208, 210 and 212 will support many wireless communication devices.

[0025] FIG. 3 is a block diagram of a multi-network gateway 300 according to one embodiment of the invention. The multi-network gateway 300 is, for example, suitable for use as the multi-network gateway 214 illustrated in FIG. 2. Specifically, the multi-network gateway 300 assumes that the multi-network gateway is facilitating the coupling of three different carrier networks to the Internet. As illustrated in FIG. 2, the three carrier networks are referred to as carrier network A , carrier network B, and carrier network C.

[0026] The multi-network gateway 300 includes a push agent 302 and a pull agent 304. The push agent 302 and the pull agent 304 are in general agents or processing modules within the multi-network gateway 300 that serve to provide wireless communication devices with access to information from the Internet 216. The push agent 302 operates to "push" information content from the Internet to the wireless communication devices. The pull agent 304 operates to "pull" information content from the Internet 216 when requested by the wireless communication devices. The push agent 302 and pull agent 304 are coupled to the Internet 216 by an HTTP module 306.Also, the push agent 302 and the pull agent 304 are coupled to the carrier networks A, B and C by a wireless carrier interface 308.

[0027] In order for the multi-network gateway 300 to support the various carrier networks, the push agent 302 and the pull agent 304 include airlinks for each of the carrier networks. These airlinks are specialized programming resources that are designed to correspond and interact with the particular wireless network characteristics associated with the corresponding carrier network. The airlinks can also be referred to as network drivers because they are used to communicate with the carrier networks. In any case, the push agent 302 includes an airlink-A 310 for use with the carrier network A, an airlink-B 312 for use with the carrier network B, and an airlink-C 314 for use with the carrier network C. Similarly, the pull agent 304 includes an airlink-A' 316 for use with the carrier network A, an airlink-B' 318 for use with the carrier network B, and an airlink-C' 320 for use with the carrier network C. The corresponding airlinks (e.g., A and A') in the push agent 302 and the pull agent 304 are similar but can differ in certain aspects such as, for example, retry mechanisms or delivery acknowledgments.

[0028] The multi-network gateway 300 also includes an airlink configuration table 322. The airlink configuration table 322 contains information regarding the network types and protocols used by the various carrier networks. In this described embodiment, the airlink configuration table 322 contains network types and protocols for the carrier network A, the carrier network B and the carrier network C. The airlink configuration table 332 also includes information identifying the particular airlink to be used in the multi-network gateway 300 for each of the respective carrier networks

Code Division Multiple Access (CDMA) and Global System for Mobile communications (GSM).

[0035] FIG. 6 is a block diagram of a communication system 600 according to an embodiment of the invention. The communication system 600 includes a networkgateway602 that facilitates access and retrieval of information from the Internet 216 t o the wireless communication devices 202, 204 and 206 as did the multi-network gateway 214 illustrated in FIG. 2. The communication system 600, however, specifically pertains to the situation where the carrier network A 208 is a packet-switched network such as CDPD, the carrier network B 210 is a SMS-type network using CDMA with an interface protocol of SMPP, and the carrier network C 212 is another SMS-type network that uses GSM with an interface protocol of UCP.

[0036] Since the carrier network B 210 and the carrier network C 212 are circuit switched networks using SMS, they use Small Message Server Centers (SMSCs) and Inter-Working Functions (IWF) to provide communication with the carrier networks. The use of the SMSCs and the IWFs are conventional and typically provided by the carrier networks so that messaging and interaction can be achieved with the carrier networks. Hence, the communication system 600 includes SMSC-B 604 and SMSC-C 606 which respectively provide message services to wireless communication devices coupled to the carrier network B 210 and the carrier network C 212, respectively. The SMSCs 604 and 606 provide one-way notifications from the multi-network gateway 602 to the wireless communication devices on the carrier network B 210 and the carrier network C 212, respectively. The IWF-B 608 and the IWF-C 610 are respectively used to provide two-way interaction between the network gateway 602 and the carrier network-B 210 and the carrier network-C 212, respectively. The SMSC connections to the carrier networks are typically referred to as narrowband channels, whereas the IWF connections to the carrier networks are wideband channels.

[0037] FIG. 7 is a detailed diagram of the network gateway 602 illustrated in FIG. 6. In particular, the network gateway 602 includes a push agent 702 and a pull agent 704. The push agent 702 is associated with a narrowband channel between the network gateway 602 and the carrier networks B and C 210 and 212. More particularly, the push agent 702 includes a plurality of airlinks that are associated with the carrier networks of the communication system 600. Specifically, the push agent 702 includes an airlink-A 706 for use with the carrier network A 208, an airlink-B 708 for use with the carrier network B 210, and an airlink-C 710 for use with the carrier network C 212. Each of the airlinks 706, 708 and 710 are designed to properly interact with the characteristics with the associated wireless carrier network. The airlink-A 706 is coupled to the carrier network A 208 which is, for example, a CDPD network. The airlink-B 708 is coupled to the carrier network B 210 through the SMSC-B 604 because the carrier network B 210 is a circuit-switched type of network that requires use of an SMSC. Likewise, the airlink-C 710 couples to the carrier network C 212 through the SMSC-C 606 because the carrier network C 212 is also a circuit-switched type of network that requires use of a SMSC. Hence, the push agent 702 is able to "push" a notification triggered by an application server on the Internet 216 to an appropriate one or more of the wireless communication devices 202, 204 and 206.

[0038] The push agent 702 is generally used to "push" information from the Internet 216 to the wireless communication devices. The information being pushed is normally a notification. For example, an e-mail application on the Internet might push a subscriber a notification that they have new e-mail waiting. Another example is a stock application on the Internet that might push a subscriber a notification that they have updated stock information available. If a notification from an application on the Internet 216 is destined for the wireless communication device 202, the notification would be provided to the push agent 702. The push agent 702 then determines that the airlink-A 706 should be used for communicating with the wireless communication device 202. The push agent 702 then directs the notification to the airlink-A 706 which in turn forwards the notification in the suitable format to the carrier network-208. The carrier network A 208 then forwards the notification in a wireless manner to the wireless communication device 202. If a notification from an application on the Internet 216 is destined for the wireless communication device 204, the notification is provided to the push agent 702. The push agent 702 then determines that the airlink-B 708 should be used for communicating with the wireless communication device 204. The push agent 702 then directs the notification to the airlink-B 708 which in turn forwards the notification in the suitable format to the SMSC-B 604. The SMSC-B 604 then forwards the notification to the carrier network B 210 which in turn forwards the notification in a wireless manner to the wireless communication device 204. Similarly, if the notification is destined for the wireless communication device 206, the notification is provided to the push agent 702. The push agent 702 then determines that the airlink-C 710 should be used for communicating with the wireless communication device 206. The push agent 702 then directs the notification to the airlink-C 710 which in turn forwards the notification in the suitable format to the SMSC-C 606. The SMSC-C 606 then forwards the notification on to the carrier network C 212 which then in turn forwards the notification in a wireless manner to the wireless communication device 206.

[0039] The pull agent 704 is generally used to "pull" information from the Internet 216 and provide it to the wireless communication devices. The "pulling" of information from the Internet 216 is usually a bi-directional communication using the HTTP protocol at the Internet side and different wireless network characteristics on the carrier network side. Hence, the pull agent 704 performs conversion processing between the HTTP protocol and the various protocols used by the associated wireless carrier networks coupled to the pull agent 704. In this regard, the pull agent 704 includes an airlink for each of the associated carrier networks. The airlink for a particular carrier network performs the conversion

B 806 and the airlink NBR-C 808 in FIG. 8A.

[0044] FIG. 9 illustrates a communication system 900 that provides two-way communications over a narrowband channel according to another embodiment of the invention. More particularly, the communication system 900 provides two-way SMS as a narrowband channel without additionally having a separate wideband channel. However, the communication system 900 could also include a wideband channel if desired.

[0045] The communication system 900 includes a push agent 902, a pull agent 904 and a NB-router 906. The pull agent 902 includes an airlink-NBR-A 908 and an airlink-NBR-B 910. The airlink-NBR-A 908 directs notification messages to a protocol adapter (PA-A) 912 in the NB-router 906 and the airlink-NBR-B 910 directs notification messages to a protocol adapter (PA-B) 914 in the NB-router 906. The NB-router 906 also includes a route table 916 that associates a port number to each of the airlinks in the push agent 902 and the pull agent 904. The route table 916 can also associate each connection with the same port. Using the route table 916, the NB-router 906 can route information between the appropriate airlinks and the SMSC units. Table 1 below illustrates a representative route table for use with the embodiment of the invention illustrated in FIG. 9, where a connection handle (for a connection) is a programming construct that allows messages to be sent or received.

Table 1

Port Number	Connection Handle	Client (Agent-Airlink)
1	H1	Push Agent-A
1	H2	Push Agent-A
2	H3	Push Agent-B
2	H4	Push Agent-B
2	H5	Push Agent-B
2	H6	Push Agent-B
3	H7	Pull Agent-A
3	H8	Pull Agent-A
4	H9	Pull Agent-B

[0046] The NB-router 906 (or the protocol adapter (PA-A) 912 itself) is able to forward notification messages from the protocol adapter (PA-A) 912 toa SMSC-A 918 which in turn forwards the messages toa carrier network A 920.The carrier network-A 920 then forwards the notification messages in a wireless manner to wireless communication devices including the wireless communication device 922. The NB-router 906 (or the protocol adapter (PA-B) 914 itself) is likewise able to forward notification messages from the protocol adapter (PA-B) 914 to a SMSC-A 924 which in turn forwards the messages to a carrier network B 926. The carrier network B 926 then forwards the notification messages in a wireless manner to wireless communication devices including a wireless communication device 928.

[0047] To provide two-way SMS, the NB-router 906 needs to provide for receiving requests from the wireless communication devices 922 and 928 back to the multi-network gateway or, more specifically, the pull agent 904. With two-way SMS, requests from the wireless communication device 922 can be forwarded in a wireless manner to the carrier network A 920. The carrier network A 920 then forwards the request to the SMSC-A 918. The request is then forwarded by the SMSC-A 918 to the protocol adapter (PA-A) 912. Then, using the port table 916, the appropriate port associated with an airlink-NBR-A' 930 within the pull agent 904 is identified. The protocol adapter (PA-A) 912 then forwards the request from the wireless communication device 922 to the port of the pull agent 904 where the airlink-NBR-A' 930 is waiting to receive such request. In a similar manner, when the wireless communication device 928sends a request for information from the Internet 216, the request is sent in a wireless manner to the carrier network B 926. The carrier network B 926 then forwards the request onto the SMSC-B 924. The SMSC-B 924 then forwards the request to the protocol adapter (PA-B) 914 within the NB-router 906. Then, using the port table 916, the NB-router 906 determines the port of the pull agent 904 where an airlink-NBR-B' 932 resides so that the message can be forwarded to that airlink which is waiting to receive such request.

[0048] FIG. 10 is a flow diagram of airlink formation processing 1000 according to an embodiment of the invention. The airlink formation processing 1000 initially reads 1002 configuration information from a configuration table. For example, the configuration table is the airlink configuration table 322 illustrated in FIG. 3 and has contents such as represented by the airlink configuration table 400 illustrated in FIG. 4. After the configuration information is read, an airlink is created 1004 in the push agent for each network type with each associated transport protocol. For example, with respect to the airlink configuration table 400 illustrated in FIG. 4, at least three (3) airlinks would be created in the

reply PDU. After the appropriate airlink is identified, the reply PDU is forwarded 1222 to the identified airlink within the pull agent. The identified airlink within the pull agent then sends 1224 the reply PDU to the target address. Here, by the airlink sending the reply PDU to the target address, the reply PDU is forwarded to the appropriate carrier network then on to the wireless communication device that originally requested the information it now receives in the reply PDU. Following block 1224 the pull agent processing 1200 is complete and ends.

[0057] It should be noted that the push agent processing 1100 and the pull agent processing 1200 are preferably implemented in an multi-threaded manner. As such, multiple operations can be performed concurrently for improved efficiency. Also, those skilled in the art should recognize that the decision blocks 1102, 1202 and 1216 would be implemented by separate threads that wait to receive the associated items such that the processing resources of the multi-network gateway are not inefficiently used in constantly polling for the items.

[0058] Additional details on the design, construction and operation of network gateways and mobile devices are contain in (1) U.S. Application No. 08/570,210, entitled "METHOD AND ARCHITECTURE FOR AN INTERACTIVE TWO-WAY DATA COMMUNICATION NETWORK"; (2) U.S. Application No. _____, entitled "METHOD AND SYSTEM FOR INTEGRATING NARROWBAND AND WIDEBAND DATA TRANSPORTS", by Stephen S. Boyle et al., filed concurrently herewith; and (3) U.S. Application No. _____, entitled "METHOD AND APPARATUS FOR TRANSCODING CHARACTER SETS BETWEEN INTERNET HOSTS AND THIN CLIENT DEVICES OVER DATA NETWORKS", by Russell S. Greer et al.; each of these applications are hereby incorporated by reference in their entireties. Additional details concerning Internet protocols, namely, Hypertext Transfer Protocol (HTTP), can be found in Fielding et al., HTTP 1.1, August 12, 1996, which is hereby incorporated by reference.

[0059] The advantages of the invention are numerous. One advantage of the invention is that different carrier networks are able to interact with the Internet is an efficient and cost effective manner. Another advantage of the invention is that information providers are able to build services such that subscribers can obtain information in a relatively simple manner without having to deal with the myriad of different wireless network characteristics. Still another advantage of the invention is that application servers on the Internet are able to provide information to subscribers of wireless networks without to seriously concern themselves with having to deal with the myriad of different wireless network characteristics. Yet another advantage of the invention is that by centralizing the network access, physical resources are better utilized and software development cost are reduced.

[0060] The many features and advantages of the present invention are apparent from the written description, and thus, it is intended by the appended claims to cover all such features and advantages of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

Claims

1. A system for delivery of information from a network of computers to wireless communication devices, said system comprising:-

   a plurality of wireless communication devices, said wireless communications devices including a processing unit and a display screen;
   a plurality of wireless network carriers, each of said wireless network carriers providing wireless communication services to said plurality of wireless communication devices, and a plurality of said wireless network carriers using a different combination of network type and transport protocol;
   a network of computers, one or more of the computers of said network of computers containing information; and
   a multi-network gateway, said multi-network gateway coupling said wireless network carriers to said network of computers to facilitate data transfer therebetween;
   wherein each of the plurality of said wireless network carriers using the different combination of network type and protocol are coupled to said network of computers by an airlink configured for the particular combination of network type and protocol, and each of the airlinks operate to exchange data with certain of said wireless communication devices via said wireless network carriers associated therewith.

2. A system as recited in claim 1, wherein said multi-network gateway comprises:-

   a pull agent;
   wherein said pull agent operates to receive a request from a particular one of said wireless communication devices via a particular one of said plurality of wireless network carriers for information residing on said network of computers, then operates to formulate a network request for the information using a protocol associated

network carriers, said pull agent operates to receive information requests for information from the Internet from particular ones of the wireless communications devices, to form HTTP requests to request the information from the Internet via said HTTP interface module, to thereafter receive HTTP responses from the Internet containing the information requested, to form information replies for the particular ones of the wireless communications devices based on the HTTP responses, and then to send the information replies to the particular ones of the wireless communications devices as per the information requests using the network driver associated with the wireless network carrier respectively used by the particular ones of the wireless communications devices.

10. A method for exchanging data between the Internet and wireless communication devices, said method comprising:

(a) identifying an incoming request for data from the Internet from a first wireless communication device of a plurality of wireless communication devices, the incoming request being via a first carrier network of a plurality of carrier networks of different network types which use different protocols, the first carrier network having a first network type and using a first protocol;
(b) associating the incoming request for data with a first network driver configured to receive requests for data from the first carrier network in accordance with the first network type and the first protocol;
(c) receiving the incoming request for data at the first network driver;
(d) forming an HTTP request for data based on the received request for data; and
(e) forwarding the HTTP request for data to the Internet.

11. A method as recited in claim 10, wherein said associating step (b) comprises:-

(b1) receiving a source identifier from the incoming request for data, the source identifier uniquely identifies the first wireless communication device; and
(b2) determining the first network driver from a plurality of network drivers based on the source identifier.

12. A method as recited in claim 11, wherein said determining step (b2) operates to retrieve the identity of the first network driver from an account information table based on the source identifier.

13. A method as recited in any one of claims 10 to 12, wherein said method comprises:

(f) receiving a HTTP response from the Internet, the HTTP response containing the data requested by the HTTP request;
(g) formulating a reply to the first wireless communication device based on the HTTP response;
(h) forwarding the reply to the first network driver; and
(i) sending the reply to the first wireless communication device using the first network driver, the first network driver being configured to send data to the first wireless communication device from the first network driver via the first carrier network in accordance with the first network type and the first protocol.

14. A method for providing data from a wired network to wireless communication devices, said method comprising:-

(a) receiving a notification from the wired network that is to be directed to a first wireless communication device of a plurality of wireless communication devices via a first carrier network of a plurality of carrier networks of different network types which use different protocols, the first carrier network having a first network type and using a first protocol;
(b) formulating a notification message to inform the first wireless communication device of the notification;
(c) determining a first network driver associated with the first wireless communication device from a plurality of network drivers, the first network driver being configured to send notification messages to the first wireless communication device via the first carrier network in accordance with the first network type and the first protocol; and
(d) sending the notification message to the first wireless communication device using the first network driver.

15. A method as recited in claim 14, wherein the notification message includes a target address, and wherein the notification message is directed to the target address by the first network driver via the first carrier network, thereby directing the notification message to the first wireless communication device.

16. A computer readable medium containing program code for interactive data exchange between a wired network

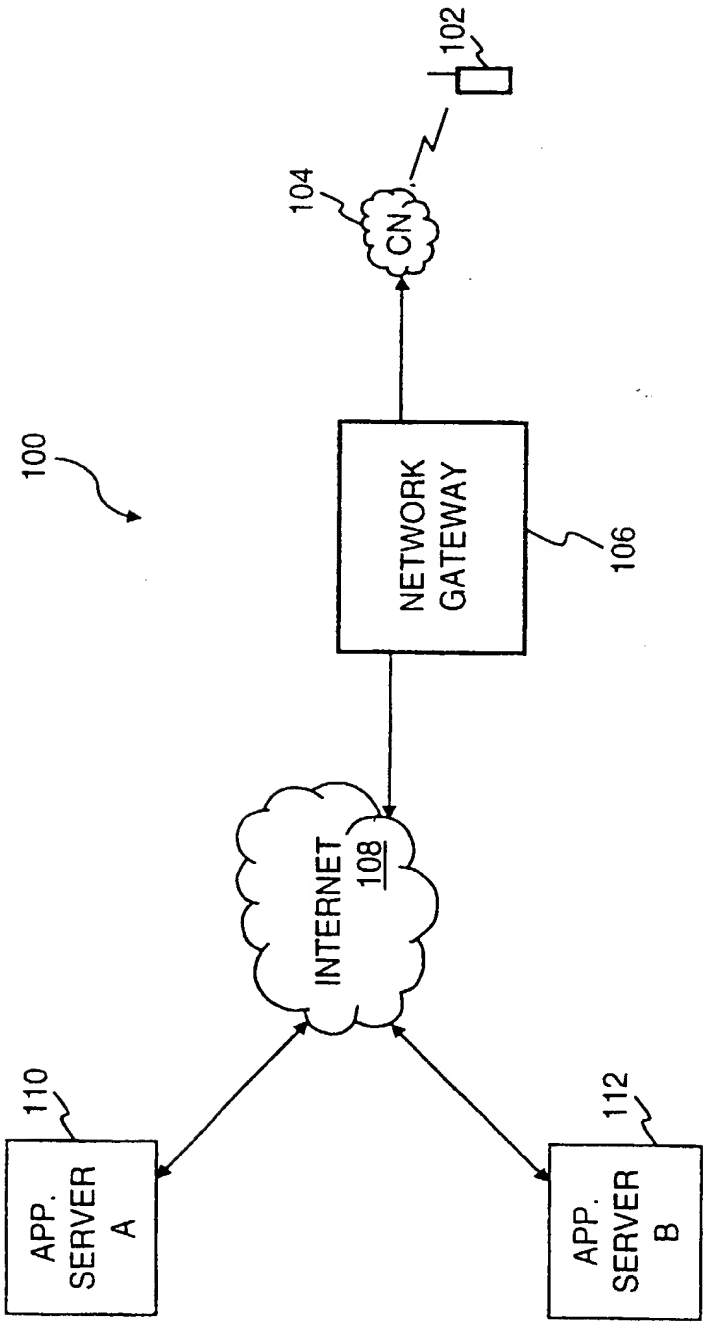

Fig.1(PRIOR ART)

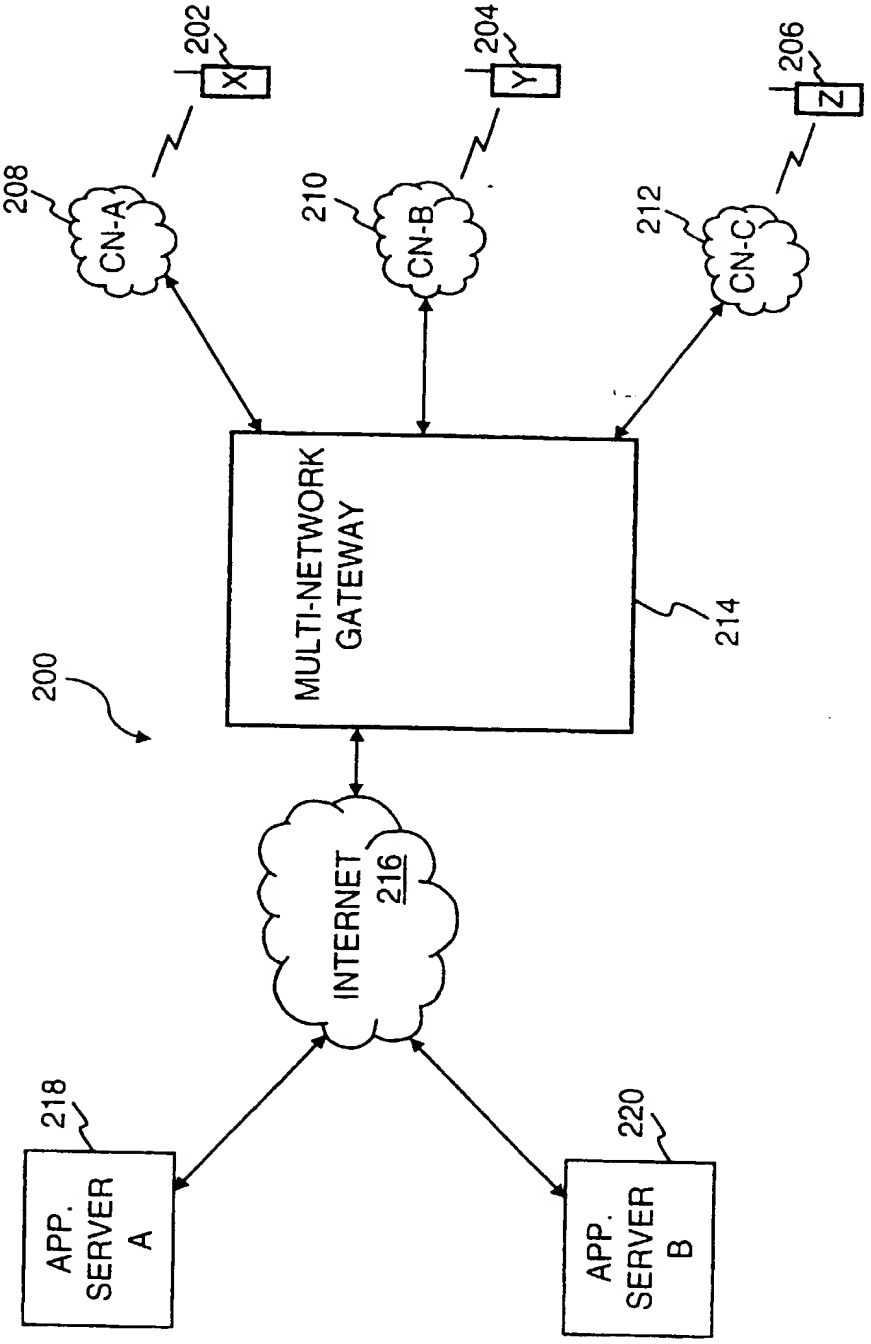
202
X
204
Y
206
Z
208
CN-A
210
CN-B
212
CN-C
MULTI-NETWORK GATEWAY
214
200
INTERNET 216
218
APP. SERVER A
220
APP. SERVER B

Fig.2

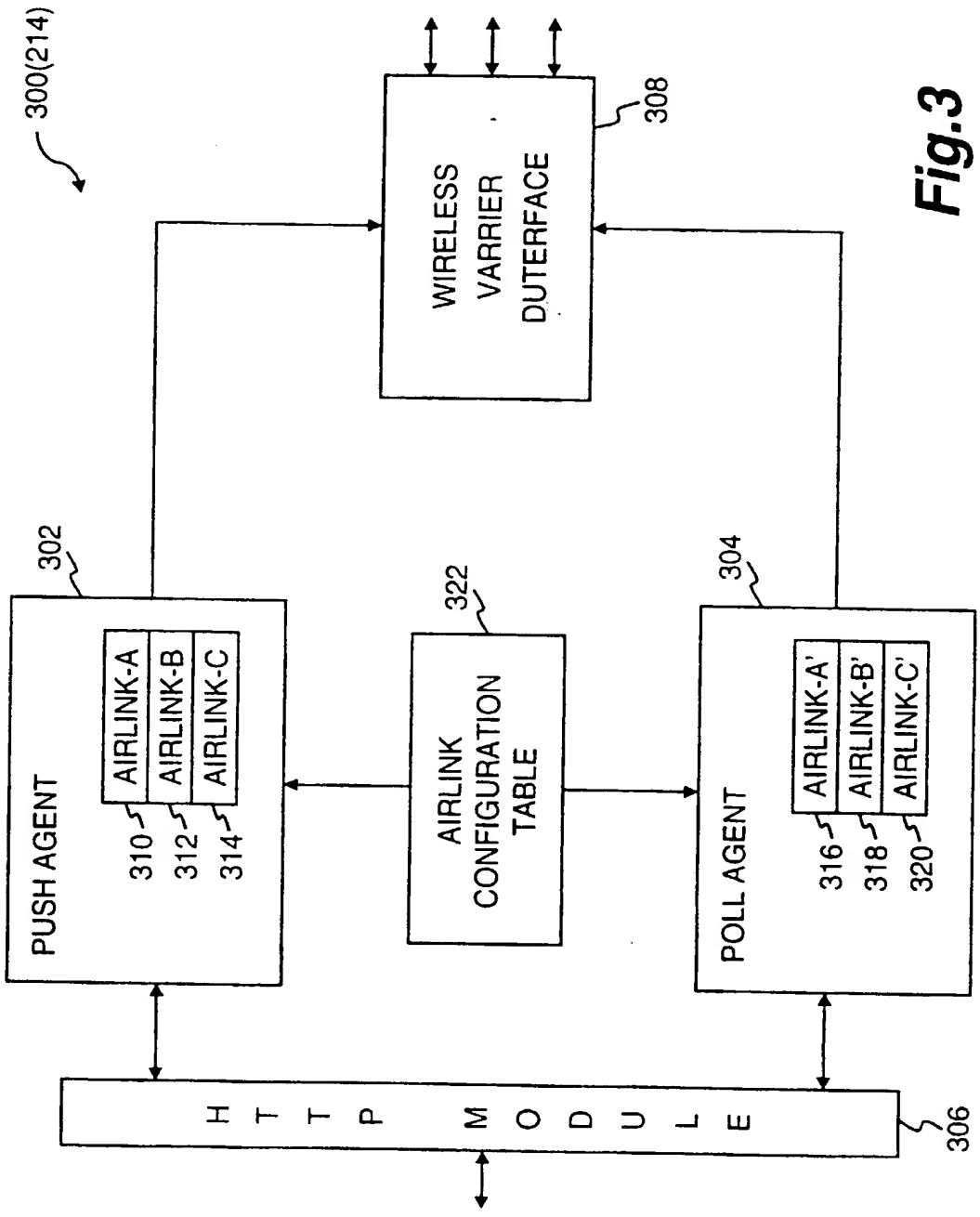
300(214)
WIRELESS VARRIER DUTERFACE
308
302
PUSH AGENT
AIRLINK-A
AIRLINK-B
AIRLINK-C
310
312
314
322
AIRLINK CONFIGURATION TABLE
304
POLL AGENT
AIRLINK-A'
AIRLINK-B'
AIRLINK-C'
316
318
320
HTTP MODULE
306

Fig.3

Airlink ID	Carrier Name	Network Type	Carrier Transport ID	Narrowband Router Address	ENABLE
0001	ATT	CDPD	UDP		Y
0002	Qualcoum	SMS-1/CDMA	SMPP		Y
0003	Sprint	SMS-1/CDMA	EIP		N
0004	Talia	SMS-1/GSM	CMG		Y
⋮	⋮	⋮	⋮	⋮	

400(322)

Fig.4

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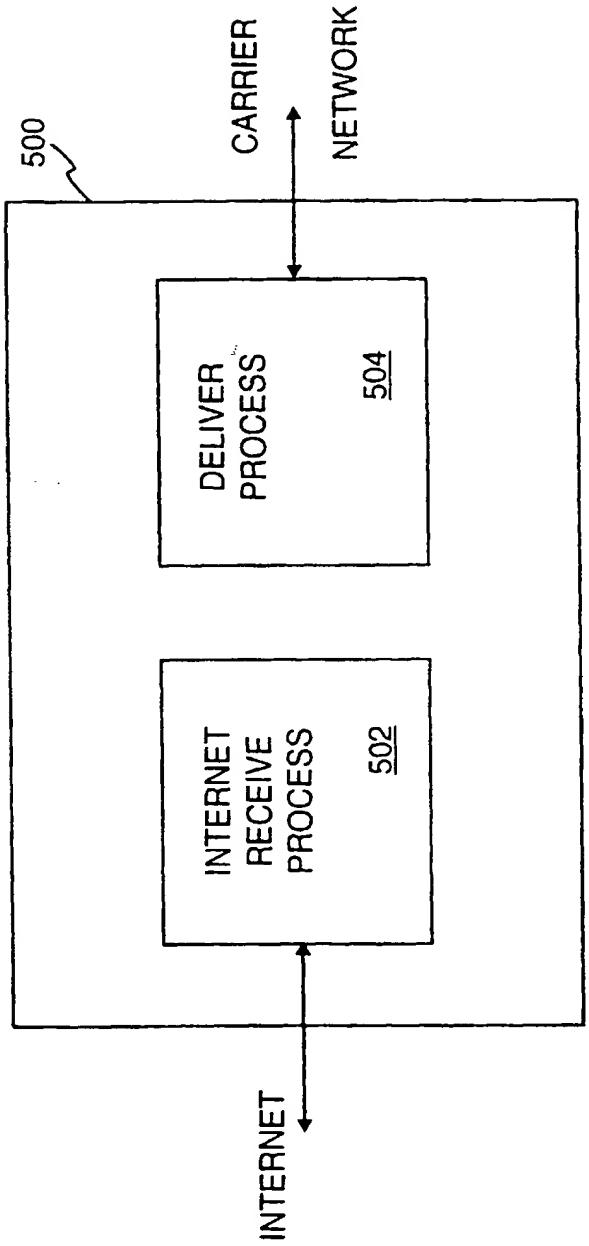
500
CARRIER
NETWORK
DELIVER PROCESS
504
INTERNET RECEIVE PROCESS
502
INTERNET

Fig.5A

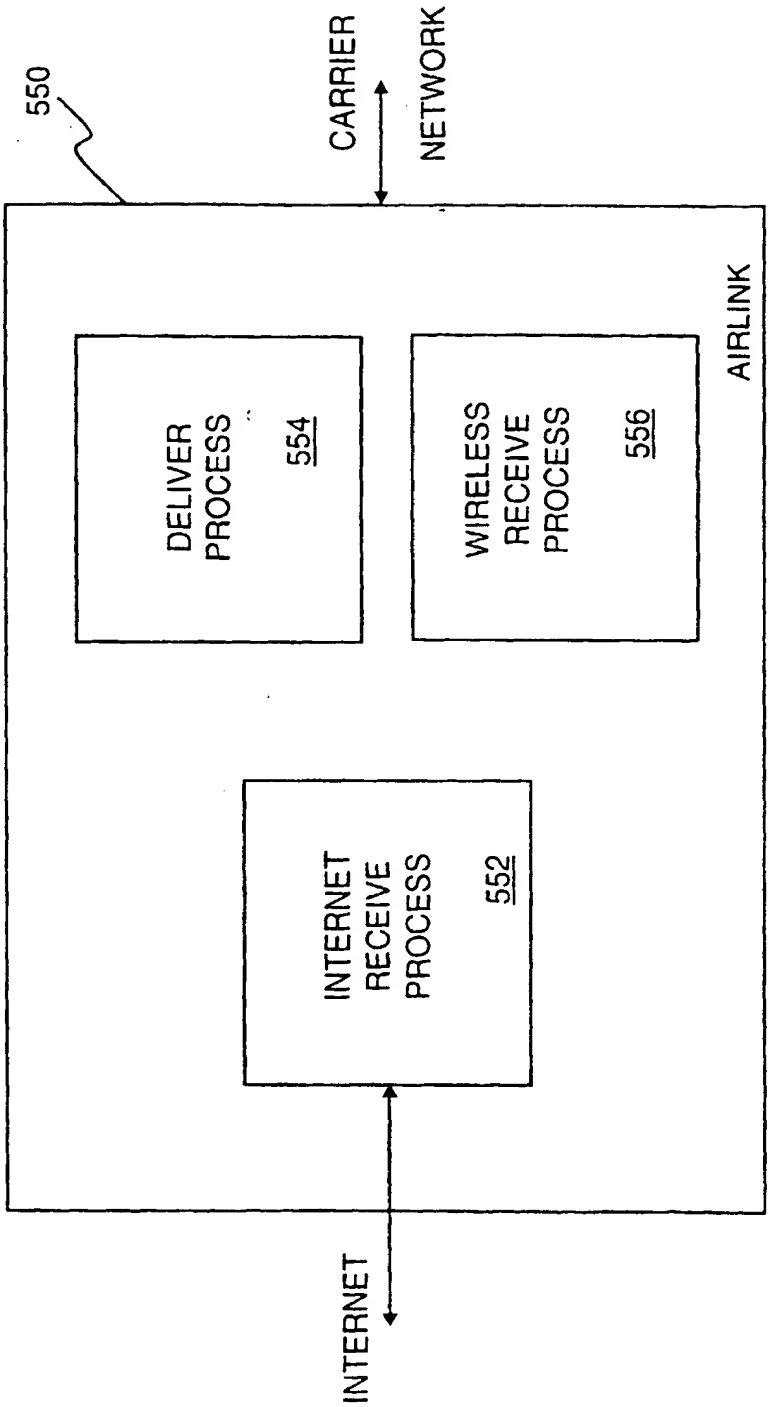
550
CARRIER
NETWORK
AIRLINK
DELIVER PROCESS
554
WIRELESS RECEIVE PROCESS
556
INTERNET RECEIVE PROCESS
552
INTERNET

Fig.5B

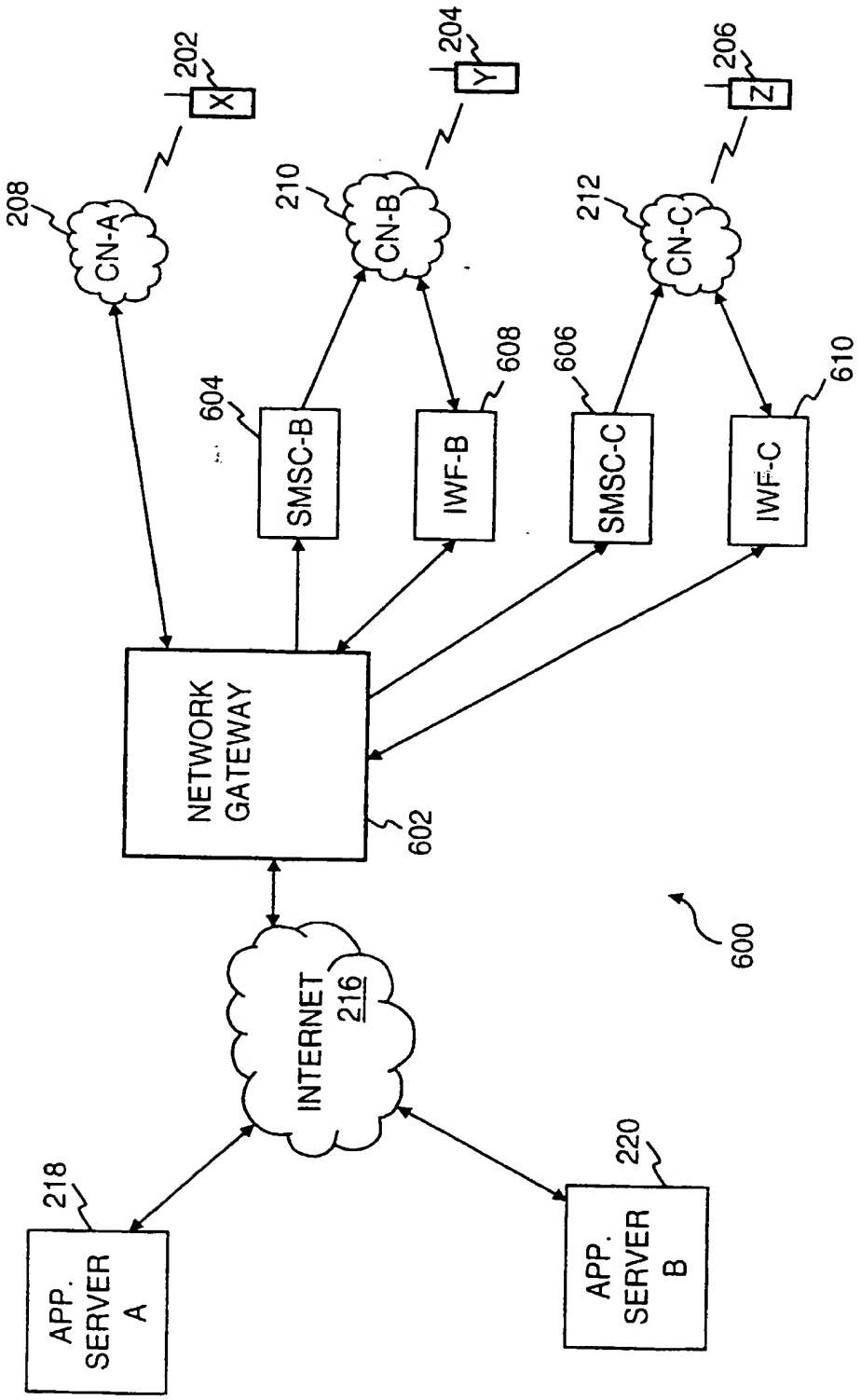
202
X
204
Y
206
Z
208
CN-A
210
CN-B
212
CN-C
604
SMSC-B
608
IWF-B
606
SMSC-C
610
IWF-C
NETWORK GATEWAY
602
600
INTERNET 216
218
APP. SERVER A
220
APP. SERVER B

Fig.6

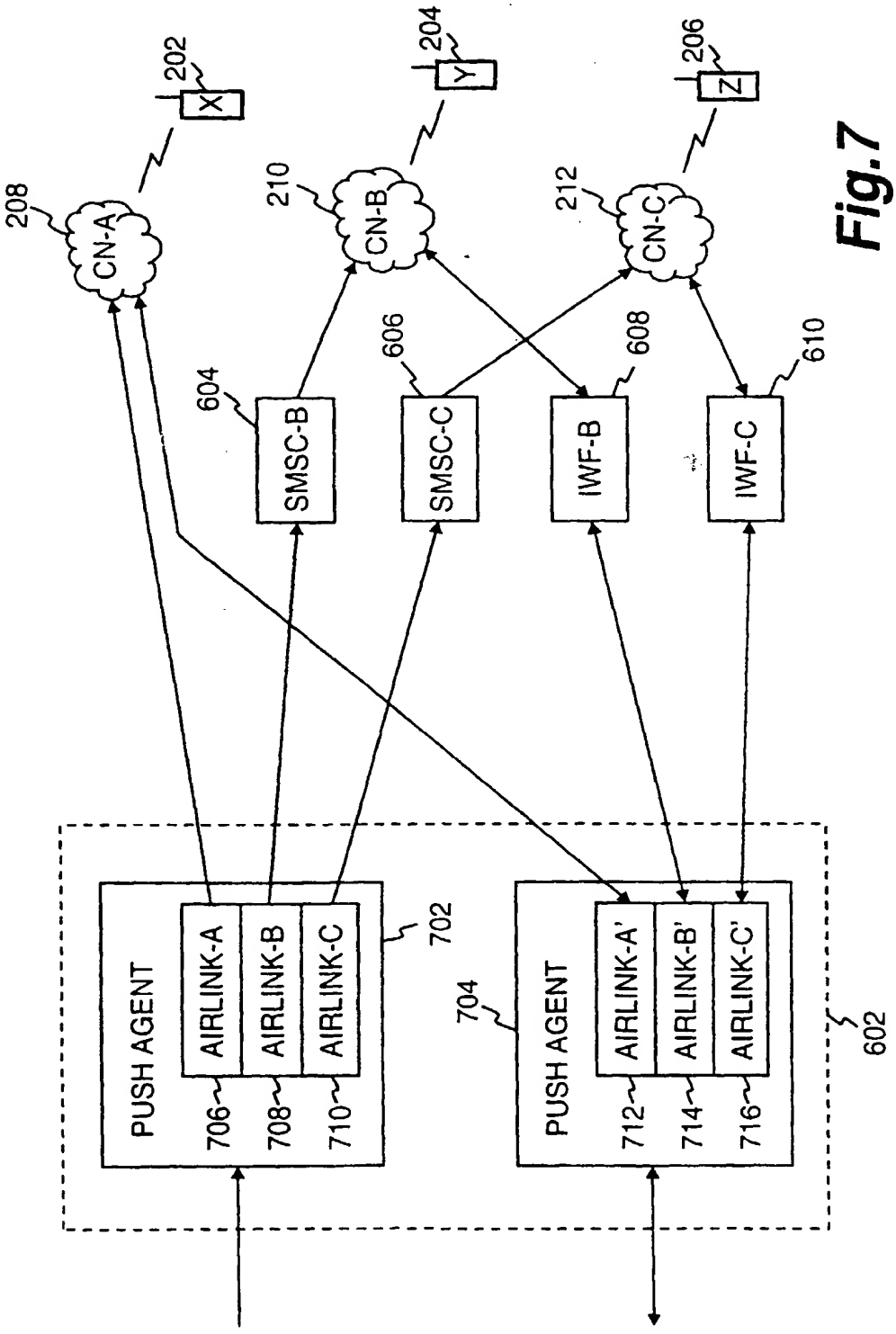
202
X
204
Y
206
Z
208
CN-A
210
CN-B
212
CN-C
604
SMSC-B
606
SMSC-C
608
IWF-B
610
IWF-C
PUSH AGENT
AIRLINK-A
AIRLINK-B
AIRLINK-C
706
708
710
702
704
PUSH AGENT
AIRLINK-A'
AIRLINK-B'
AIRLINK-C'
712
714
716
602

Fig.7

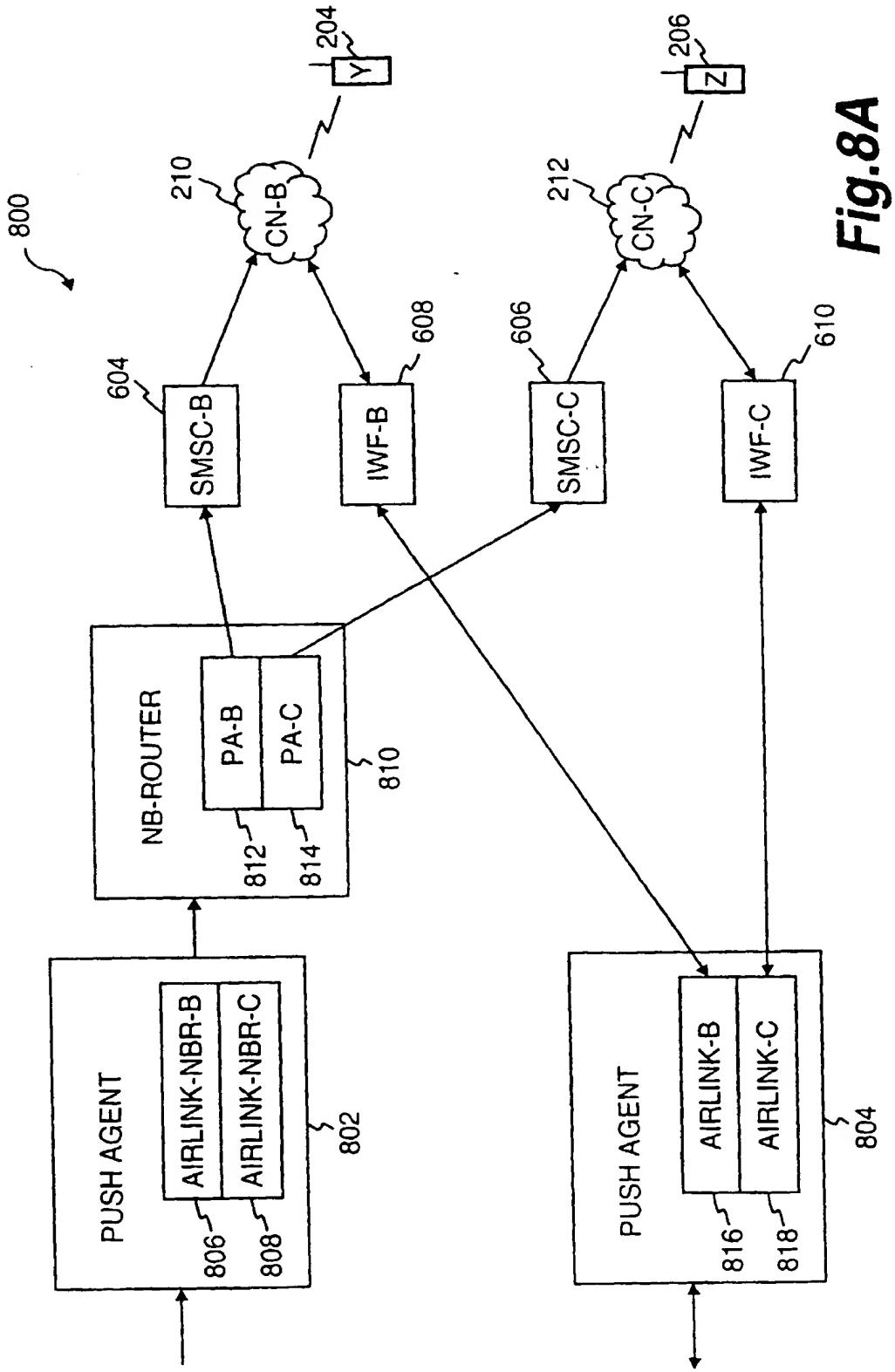
800
210
CN-B
204
Y
212
CN-C
206
Z
604
SMSC-B
608
IWF-B
606
SMSC-C
610
IWF-C
NB-ROUTER
PA-B
PA-C
810
812
814
PUSH AGENT
AIRLINK-NBR-B
AIRLINK-NBR-C
802
806
808
PUSH AGENT
AIRLINK-B
AIRLINK-C
804
816
818

Fig.8A

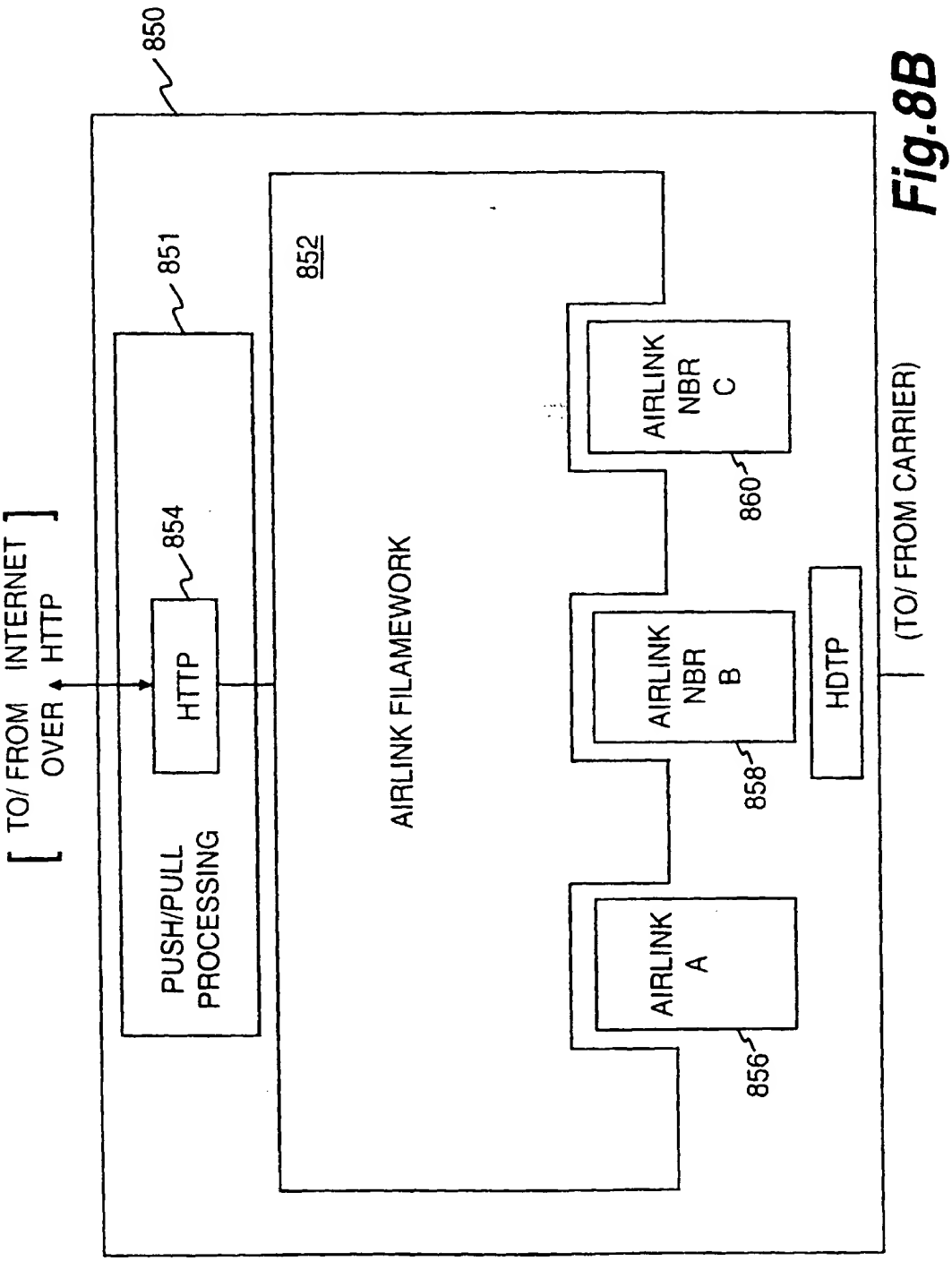
850
851
852
854
HTTP
PUSH/PULL PROCESSING
AIRLINK FILAMEWORK
AIRLINK NBR C
860
AIRLINK NBR B
858
HDTP
AIRLINK A
856
[TO/ FROM INTERNET OVER HTTP]
(TO/ FROM CARRIER)

Fig.8B

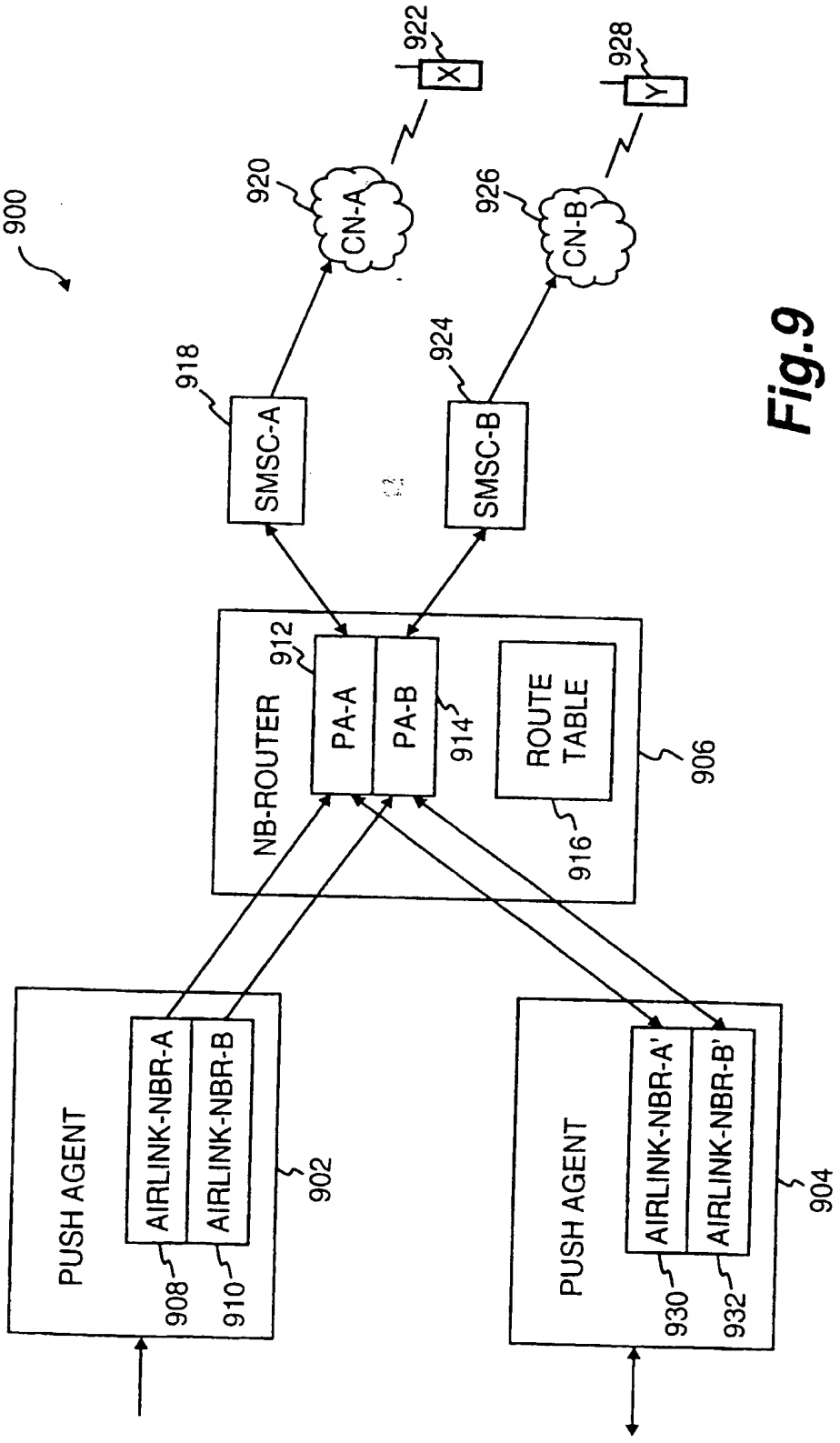
900
922
X
928
Y
920
CN-A
926
CN-B
918
SMSC-A
924
SMSC-B
NB-ROUTER
912
PA-A
PA-B
914
ROUTE TABLE
916
906
PUSH AGENT
AIRLINK-NBR-A
AIRLINK-NBR-B
908
910
902
PUSH AGENT
AIRLINK-NBR-A'
AIRLINK-NBR-B'
930
932
904

Fig.9

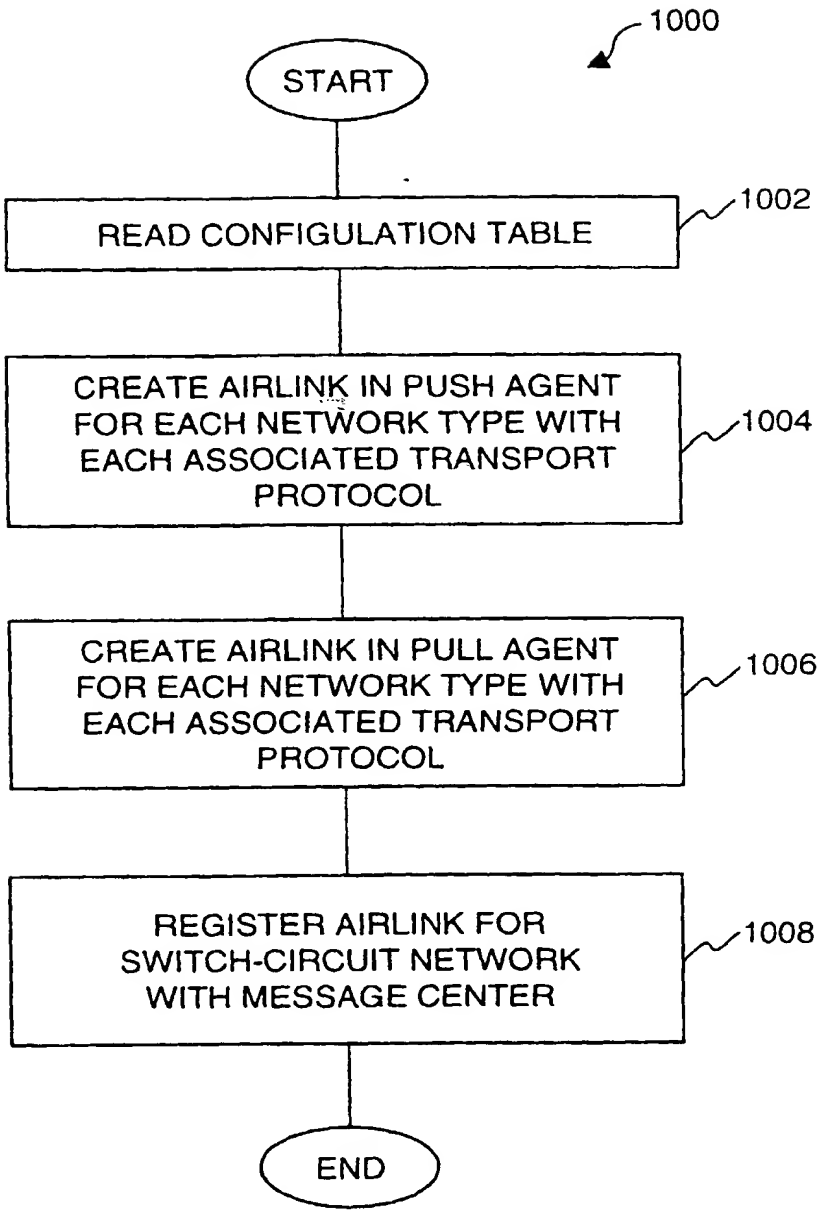
1000
START
READ CONFIGULATION TABLE
1002
CREATE AIRLINK IN PUSH AGENT FOR EACH NETWORK TYPE WITH EACH ASSOCIATED TRANSPORT PROTOCOL
1004
CREATE AIRLINK IN PULL AGENT FOR EACH NETWORK TYPE WITH EACH ASSOCIATED TRANSPORT PROTOCOL
1006
REGISTER AIRLINK FOR SWITCH-CIRCUIT NETWORK WITH MESSAGE CENTER
1008
END

Fig.10

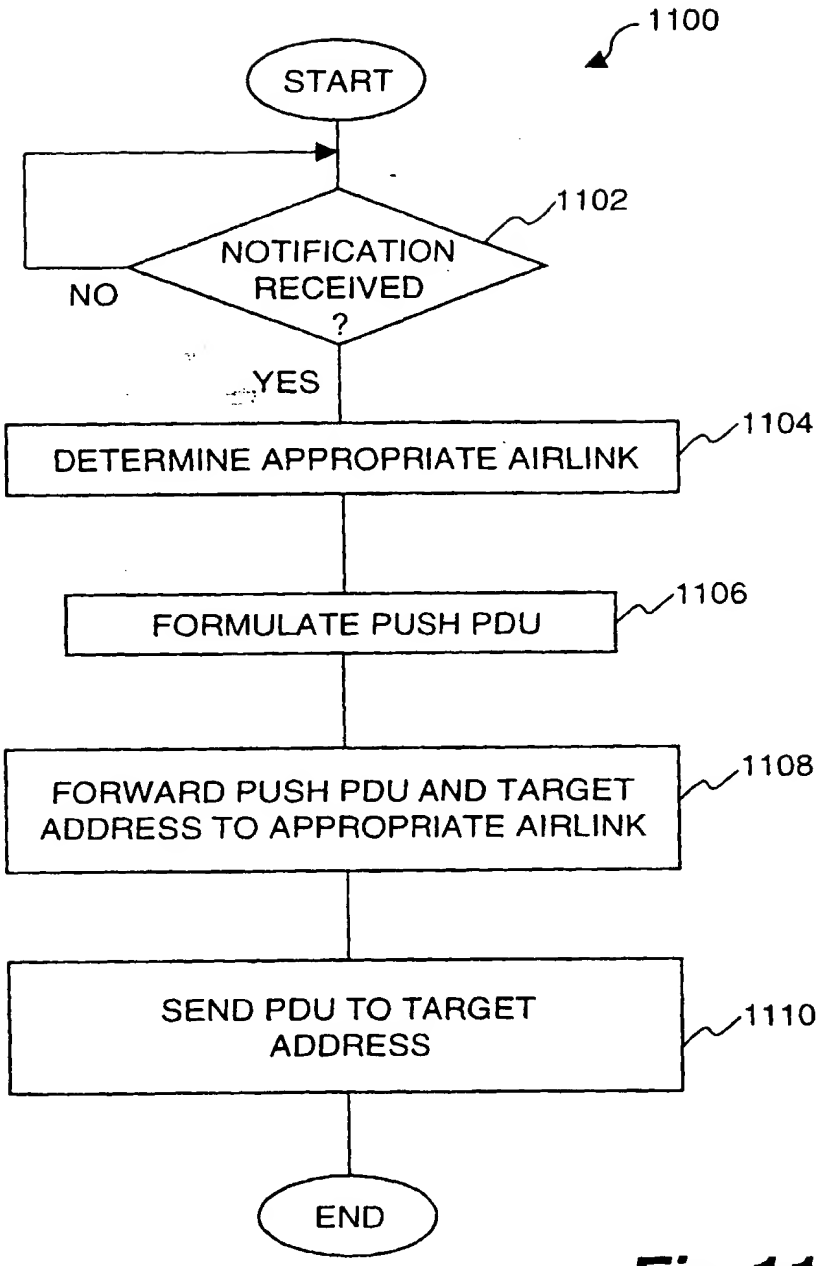
1100
START
1102
NOTIFICATION RECEIVED ?
NO
YES
1104
DETERMINE APPROPRIATE AIRLINK
1106
FORMULATE PUSH PDU
1108
FORWARD PUSH PDU AND TARGET ADDRESS TO APPROPRIATE AIRLINK
1110
SEND PDU TO TARGET ADDRESS
END

Fig.11

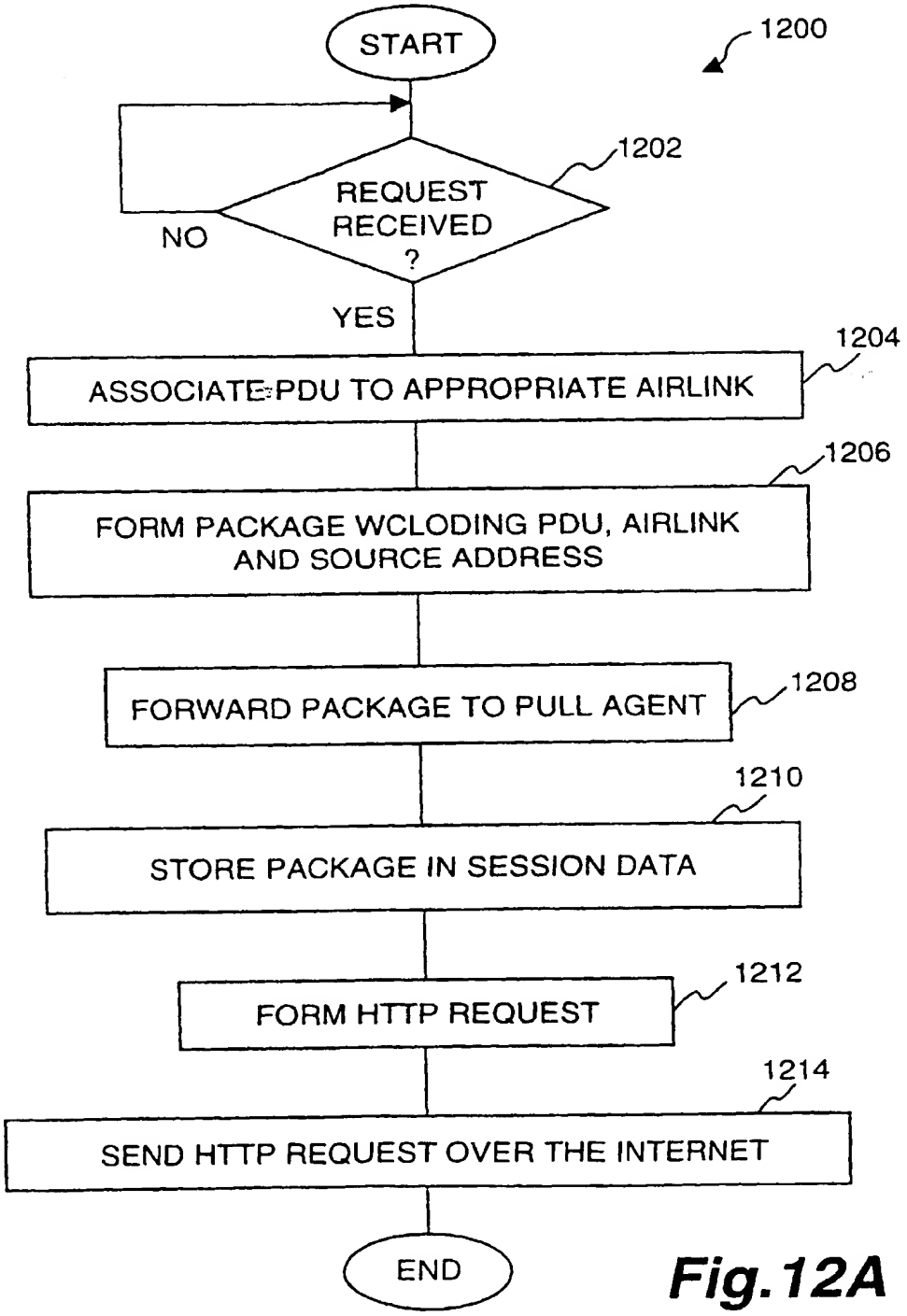
START
1200
1202
REQUEST RECEIVED ?
NO
YES
1204
ASSOCIATE PDU TO APPROPRIATE AIRLINK
1206
FORM PACKAGE WCLODING PDU, AIRLINK AND SOURCE ADDRESS
1208
FORWARD PACKAGE TO PULL AGENT
1210
STORE PACKAGE IN SESSION DATA
1212
FORM HTTP REQUEST
1214
SEND HTTP REQUEST OVER THE INTERNET
END

Fig.12A

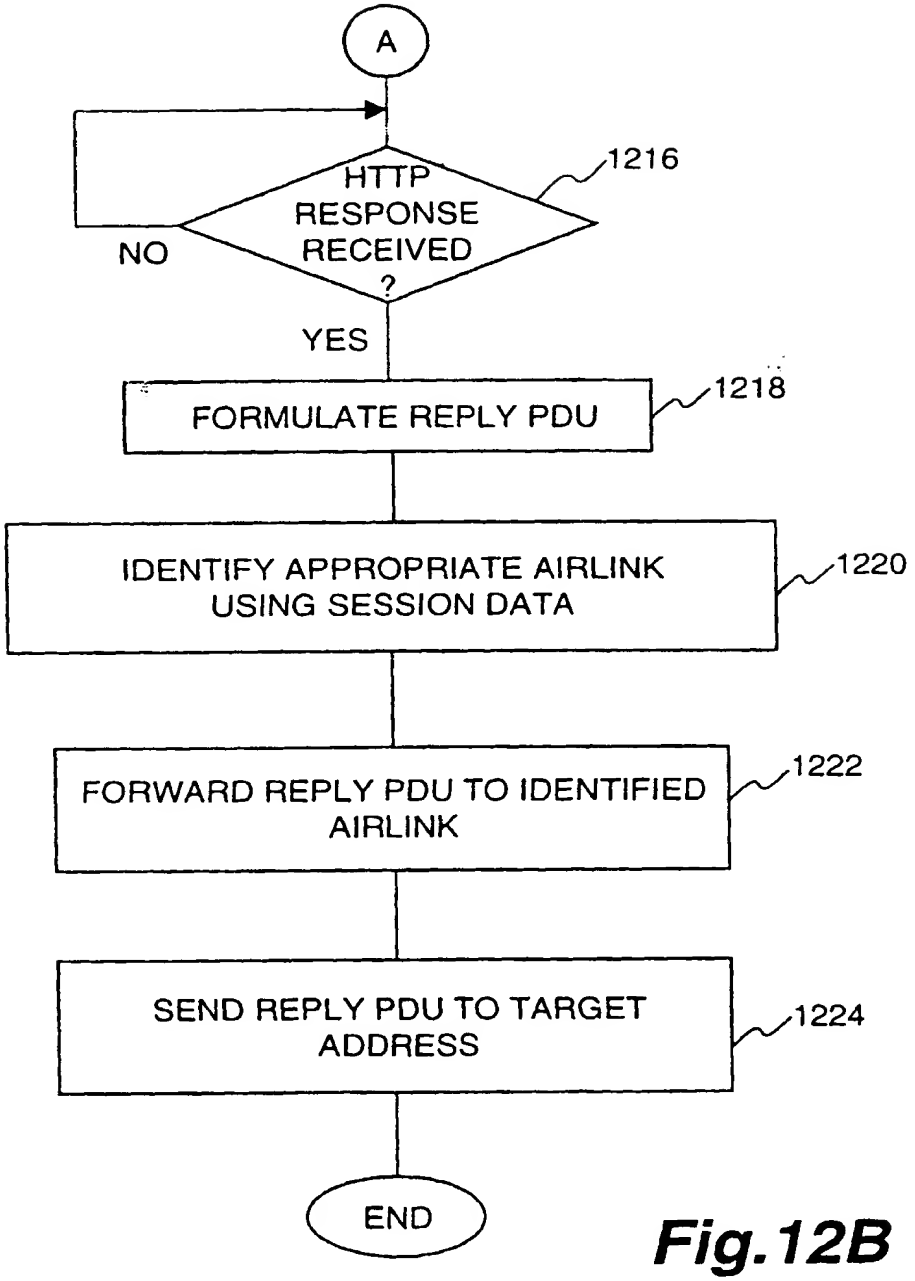
A
HTTP RESPONSE RECEIVED ?
1216
NO
YES
FORMULATE REPLY PDU
1218
IDENTIFY APPROPRIATE AIRLINK USING SESSION DATA
1220
FORWARD REPLY PDU TO IDENTIFIED AIRLINK
1222
SEND REPLY PDU TO TARGET ADDRESS
1224
END

Fig.12B

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 3352

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 742 905 A (BROCKMAN JAMES JOSEPH ET AL) 21 April 1998 (1998-04-21) * column 3, line 34 - line 59 * * column 4, line 32 - line 36 * * column 5, line 27 - column 8, line 58 * * column 9, line 1 - line 41 * * column 10, line 55 - column 11, line 54 * * column 23, line 12 - column 24, line 64 * * column 26, line 36 - line 51 * * column 34, line 9 - column 36, line 51 *	1,8	H04L29/06
Y		2-6,14, 16,17	
A		7,9,10, 15	
Y	WO 97 41654 A (MCLORINAN ANDREW GEORGE ;TSOUKAS GEORGE JAMES (AU); ERICSSON TELEF) 6 November 1997 (1997-11-06) * page 1, line 1 - line 9 * * page 2, line 2 - page 4, line 5 * * page 5, line 11 - page 6, line 7 * * page 9, line 1 - line 28 * * claims 1,6,7 *	2-6,14, 16,17	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H04L H04Q
A		1,7-10, 15	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 September 1999	Vaskimo, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 3352

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	FUJINO N ET AL: "MOBILE INFORMATION SERVICE BASED ON MULTI-AGENT ARCHITECTURE" IEICE TRANSACTIONS ON COMMUNICATIONS, vol. E80-B, no. 10, 1 October 1997 (1997-10-01), pages 1401-1406, XP000734533 ISSN: 0916-8516 * page 2, right-hand column - page 3, right-hand column *	2,5,7,9, 10,14, 16,17	
A	WU C -S ET AL: "INTERNET ACCESS FOR PERSONAL MOBILE EQUIPMENTS IN A WIRELESS WAN ENVIRONMENT" IEEE TRANSACTIONS ON CONSUMER ELECTRONICS, vol. 43, no. 3, 1 August 1997 (1997-08-01), pages 873-878, XP000742574 ISSN: 0098-3063 * abstract * * the whole document *	2,5,7,9, 10,14, 16,17	
A	US 5 673 322 A (BROCKMAN JAMES JOSEPH ET AL) 30 September 1997 (1997-09-30) * column 5, line 32 - column 6, line 29 * * column 7, line 10 - column 9, line 40 * * figures 2-4 *	2,5,7,9, 10,14, 16,17	TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 September 1999	Vaskimo, K

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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